AL.1.1151 c.2

Rock Chips

Winter 2006

Alberta Geological Survey

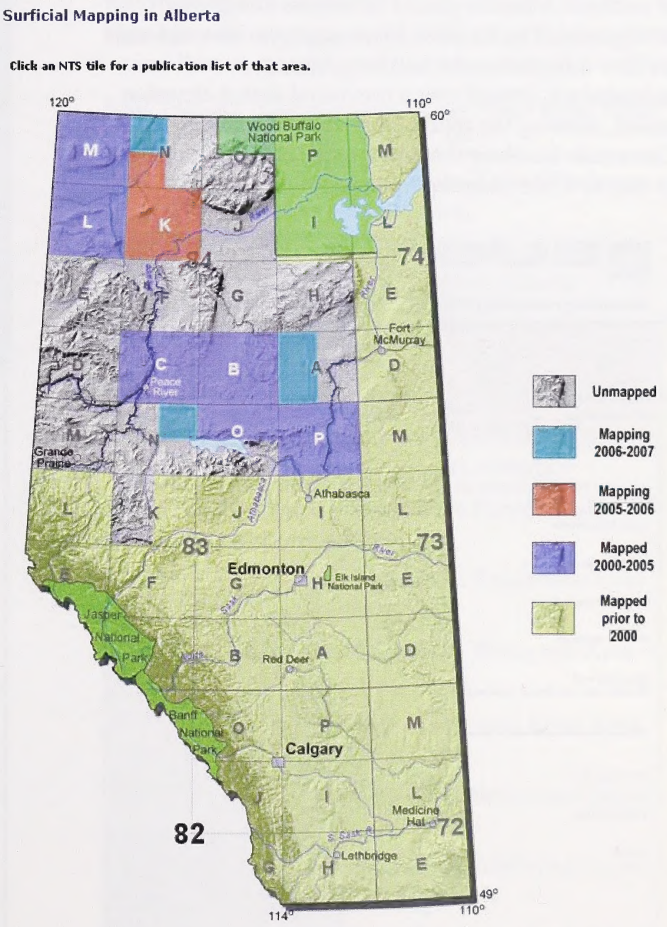
Surficial Geology Mapping Web Page Launched

In 2000, the Alberta Geological Survey (AGS) initiated a long-term, regional surficial mapping program of northern Alberta. This program benefits several stakeholders, including the mineral exploration, energy and forestry industries, by providing baseline geological information for northern Alberta. Surficial geology maps contain information on the surface sediments (the ground we live upon) and provide insights to surface material properties, morphology and genesis. The maps accommodate the increasing demand for geological information for infrastructure development and land-use planning (e.g., granular aggregate, landslide potential, permafrost) in northern Alberta.

The objective of the surficial mapping program is to complete the surficial geology mapping of northern Alberta along with complementary studies, such as ice-flow mapping, Quaternary stratigraphy and sedimentology. Ultimately, this new information will be merged with existing maps from southern and central Alberta to create a uniform surficial geology map for the entire province. The AGS is responding to increasing queries from various clients (e.g., industry, academia and government agencies) regarding existing surficial geology map and GIS data coverage within Alberta. Large portions of northern Alberta still remain unmapped, but since 2000, significant progress has been made with the mapping of seven 1:250 000 NTS areas.

Recently, a surficial mapping web page was added to the AGS website at

http://www.ags.gov.ab.ca/activities/surficial_mapping/surficial_mapping.html.



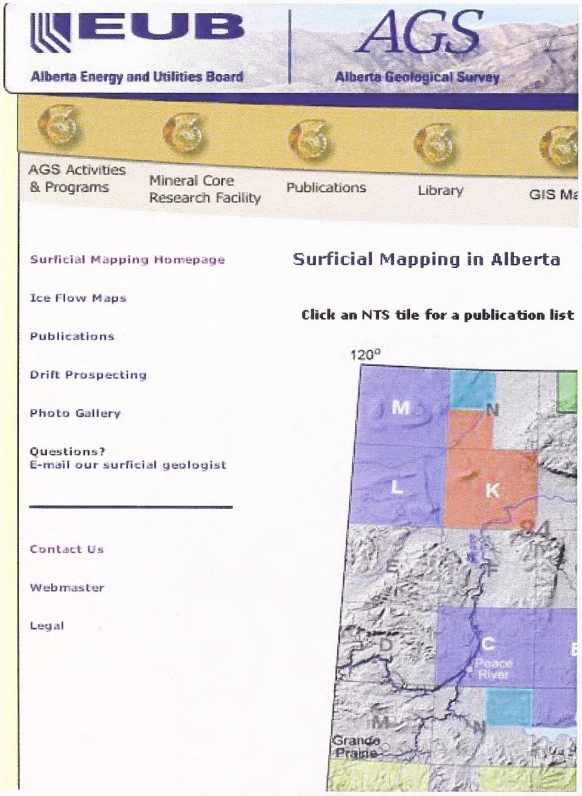
Screen capture of the surficial mapping web page showing surficial mapping coverage for Alberta. By clicking any of the NTS tiles, you can download surficial maps and reports for that area.

EUB Alberta Energy and Utilities Board

AGS

You are greeted with a map showing generalized surficial mapping coverage for Alberta. Behind this image is a dynamic search engine designed to query a database for surficial geology maps, surface materials maps, aggregate maps and other related data. Simply click an NTS tile to see what surficial geology information is available for that area. Since queries are linked to an active database, the web page will update as new maps and publications are released.

On the left side of web page are links to surficial geology and drift prospecting publications. These include reports, external papers, presentations and Rock Chips articles pertaining to the AGS surficial mapping program. There is also a photo gallery from recent surficial mapping activities highlighting some of northern Alberta's glacial landforms and glacial stratigraphy. The Ice Flow Maps page provides regional ice flow information for northern Alberta, as well as an animated gif, draped over a provincial digital elevation model, showing the approximate recession of the Laurentide Ice Sheet through a series of time slices from 16 000 to 8 500 years before present.



Close-up of Surficial Mapping home page, showing the left side with related links to other resources.

Rock Chips is published four times a year by the Alberta Geological Survey in the spring, summer, fall and winter.

Individual articles, statistics and other information in this publication may be reproduced or quoted without permission as long as the EUB/AGS is credited.

Past and present issues of *Rock Chips* may be viewed on the AGS website located at www.ags.gov.ab.ca.

To receive the paper version of *Rock Chips*, ask to be placed on our complimentary mailing list. Contact our Edmonton office by

- e-mail: EUB.AGS-Infosales@eub.ca
- Fax: (780) 422-1918
- Tel: (780) 422-3767

If you are currently receiving the paper edition and have a change of name or address, please forward corrections to one of the contacts above.

All AGS reports are available for purchase from the AGS Information Sales office in Edmonton. Orders may be placed in person or by phone, fax, or e-mail at the following address:

Alberta Energy and Utilities Board
Alberta Geological Survey
Information Sales
4th Floor, Twin Atria Building
4999 - 98th Avenue
Edmonton, Alberta
Canada T6B 2X3
Tel: (780) 422-3767
Fax: (780) 422-1918
e-mail: EUB.AGS-Infosales@eub.ca

Prepayment is required. We accept Visa/Mastercard, cheque or money order or a current EUB account number. GST is included in our prices.

Abstracts of most of our reports may be found on our website at **www.ags.gov.ab.ca.**

Clients in the Calgary area may view AGS publications at the Alberta Energy and Utilities Board Library, 640 - 5th Avenue SW.
Tel: (780) 297-8242

Screen capture of the animation showing the retreat of the Laurentide Ice Sheet in Alberta. Source: Dyke, A.S., Moore, A. and Robertson, L. (2003): Deglaciation of North America; Geological Survey of Canada, Open File 1574.

In future, this section will be expanded to include geology highlights for other areas of the province, including the Rockies, foothills, southern and central Alberta. A long-term goal is a GIS map where you can perform queries and download files on various aspects of surficial geology. ❖

Publications Re-Released in Digital Form

These publications were originally released as hard copy only. They have now been put into a PDF file and are available for download at

http://www.ags.gov.ab.ca/publications/

Bulletins

BUL 032 Urban Geology of Edmonton. **430.39 MB**

BUL 046 Oil Sands Geology-Athabasca Deposit North. **149.43 MB** PDF.

Earth Sciences Reports

ESR 1982-04 Hydrogeology of the Clear Hills-Chinchaga River Area, Alberta.

ESR 1981-02 Hydrogeology of the Peace River Area, Alberta.

ESR 1980-03 Hydrogeology of the Zama-Bistcho Lakes Area, Alberta.

ESR 1980-02 Hydrogeology of the Steen River-Whitesand River Area, Alberta.

ESR 1980-01 Hydrogeology of the Pelican-Algar Lake Area, Alberta.

ESR 1979-07 Hydrogeology of the Edson Area, Alberta.

ESR 1979-06 Hydrology of the Edmonton Area (Southeast Segment), Alberta.

ESR 1979-05 Hydrogeology of the Peerless Lake Area, Alberta.

ESR 1979-04 Hydrogeology of the Kananaskis Lake Area, Alberta.

ESR 1979-03 Hydrogeology of the Winagami Area, Alberta.

ESR 1979-01 Hydrogeology of the Sand River Area, Alberta.

ESR 1978-06 Hydrogeology of the Bitumount-Namur Lake Area, Alberta.

ESR 1978-05 Hydrogeology of the Southwest Segment, Edmonton, Alberta.

ESR 1978-02 Hydrogeology of the Oyen Area, Alberta.

ESR 1977-05 Hydrogeology of the Brazeau-Canoe River Area, Alberta.

ESR 1977-02 Hydrogeology of the Calgary-Golden Area, Alberta.

Check Out Our Library

The Alberta Geological Survey library is an excellent resource for geoscience information. The collection includes books, journals, maps, atlases, directories, federal and provincial/state geological survey documents and some EUB publications.

Our catalogue is part of the shared catalogue of the NEOS Consortium, accessible at www.ags.gov.ab.ca/library. You can search the catalogue by author, title, subject headings or keywords. The Alberta Geological Survey materials are identified by the label EUB/AB Geol Survey Library or EUB/AGS.

The EUB/AGS library is also a full, participating library within The Alberta Library (TAL) and can issue new TAL cards and add our library to existing TAL cards. For information about TAL go to www.thealbertalibrary.ab.ca.

Service Information

Access: 8:00 a.m. to 12:00 p.m. and 1:00 p.m. to 4:00 p.m., Monday to Friday.

Loan Policy: Two weeks plus one renewal for external clients.

Interlibrary Loans: Two weeks usage plus delivery time, one renewal. Requests accepted by form, fax, telephone and e-mail.

Document Delivery: Photocopies provided within copyright laws.

Contact
Linda White
Phone: (780) 422-1685
Fax: (780) 422-1918
E-mail: eub.ags-library@eub.ca
Alberta Energy and Utilities Board
Alberta Geological Survey
4th Floor, Twin Atria
4999 - 98th Avenue
Edmonton, Alberta
T6B 2X3 ❖

Story Contact Information

The following AGS staff may be contacted for further information on their articles or citations.

Surficial Geology Mapping Web Page Launched	Roger Paulen	(780) 427-2851
Check Out Our Library	Linda White	(780) 422-1685
AGS Staff Lead Geology Field Trip on Sour Gas Production and Acid Gas Injection	Maja Buschkuehle	(780) 422-2728

Staff may also be contacted via e-mail by entering the author's first name.last name@eub.ca

Comments and suggestions for Rock Chips may be sent to Maryanne Protz at maryanne.protz@eub.ca

AGS Staff Lead Geology Field Trip on Sour Gas Production and Acid Gas Injection

Over the past 15 years, oil and gas producers in Alberta and British Columbia have been faced with a growing challenge to reduce atmospheric emissions of hydrogen sulphide (H_2S), which is produced from "sour" hydrocarbon pools. Sour oil and gas are hydrocarbons that contain H_2S and CO_2, which have to be removed before the produced oil or sweet gas is sent to market. Because desulphurization is uneconomic and surface storage of the produced elemental sulphur constitutes a liability, increasingly more operators are disposing the mixture of H_2S and CO_2, also called acid gas, into deep geological formations. Although the main purpose of acid-gas injection operations is to dispose of H_2S, significant quantities of CO_2 are being injected at the same time. With the current effort to reduce CO_2 emissions, these operations are small-scale analogues to future large-scale geological storage of CO_2 (a greenhouse gas).

For the past 5 years, AGS, as part of a consortium of federal and provincial government agencies and industry partners, conducted a number of projects characterizing the subsurface geology and hydrogeology of these operations. A list of these projects can be viewed at **http://www.ags.gov.ab.ca/activities/co2/projects.shtml**

During September 18-20, 2006, the Alberta Geological Survey conducted a field trip entitled "**Source to Sink - Sour Gas Production and Acid Gas Injection in the Rocky Mountain Foothills and Alberta Plains.**" Drs. Maja Buschkuehle and Shahin Dashtgard led the field trip for representatives of the consortium.

The field trip provided an overview of the production of sour gas and the technology used to dispose of the resultant acid gas. It then focused on the geology of injection horizons by visiting outcrops of siliciclastics and carbonates in the Rocky Mountain Foothills and Front Ranges, whose subsurface equivalents are used for acid-gas injection and/or CO_2-enhanced oil recovery (EOR) elsewhere in the province.

The group left Edmonton and travelled to the Hansmann Lake gas plant near Provost, to observe and discuss sour-gas processing and acid-gas injection technologies. Participants saw the acid-gas injection well, associated gas plant operations and factors involved in delivering sweet gas downstream. The field trip leaders presented an overview of the geology and hydrogeology of the five acid-gas injection sites in the Provost area (Figures 1 and 2), four of which are currently active.

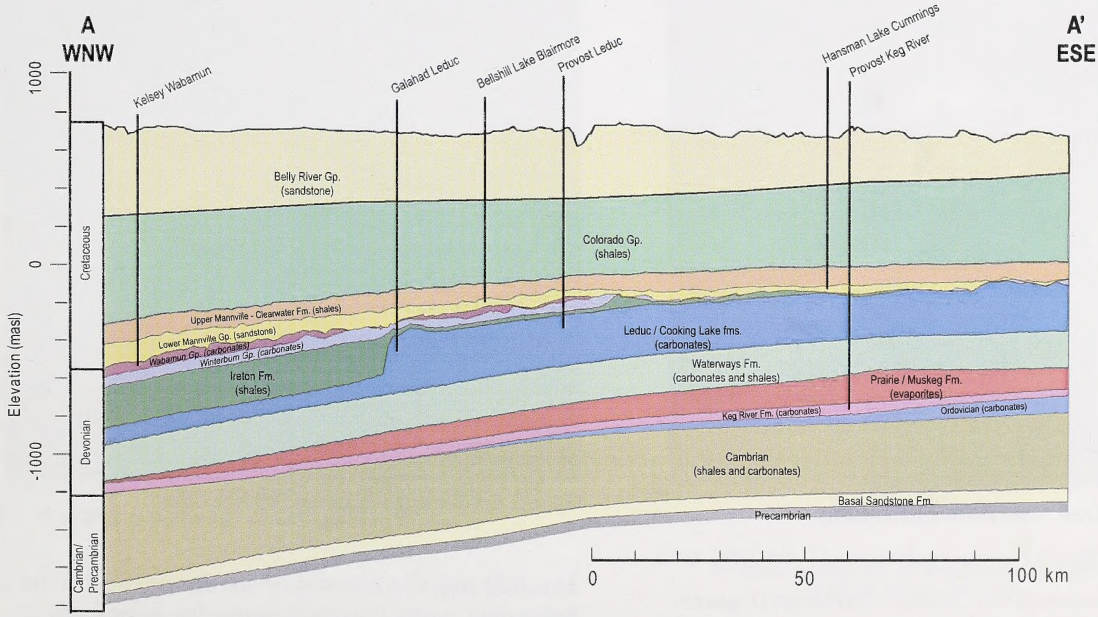


Figure 1. Stratigraphic cross-section through the Provost area showing the relative position of the various target horizons in the Devonian to Cretaceous succession for acid-gas injection. The location of the cross-section is shown in Figure 2.

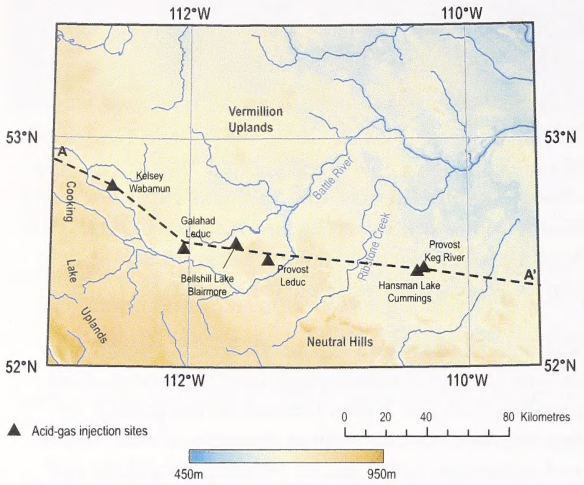


Figure 2. Topographic map of the Provost area showing the location of the acid-gas injection sites.

The field trip continued on to Big Hill Springs Provincial Park, northwest of Calgary, where groundwater, charged with calcium carbonate from the dissolution of carbonate cement in the Paskapoo sandstone, discharges and is re-precipitated as a type of limestone called tufa (Figure 3). This stop illustrated the nature and controls of fluid-rock interactions that occur when acid gases (CO_2 and/or H_2S) are injected into subsurface rock formations.

Figure 3. Bighill Creek cascades over tufa mounds.

The next stop was downstream of the Seebe Dam to examine exposures of the Cardium Formation (Figures 4 and 5) - a major oil and gas producing zone presently being evaluated for large scale CO_2-storage and enhanced oil recovery in the giant Pembina oil field southwest of Edmonton. Field trip participants were introduced to the geology, sedimentology and ichnology (tracks, trails and burrows made by organisms in the sediment) of the Cardium Formation and were given an overview of its reservoir characteristics in the Pembina field.

Figure 4. Cardium Formation below the Seebe Dam.

Figure 5. Conglomerate exposures at Seebe Dam.

This field stop was followed by one directly west of the Seebe dam, where Lafarge Concrete Inc. is presently mining thick exposures of shale (Figure 6). These shales are part of the Wapiabi Formation, which overlies the

Cardium Formation and acts as a seal to prevent the escape of hydrocarbons and CO_2 trapped in the Cardium Formation reservoirs in the Alberta subsurface. The shale quarry is associated with the Lafarge Seebe cement plant, which is an example of a high-purity CO_2 emitter.

Figure 6. Lafarge shale quarry near Seebe.

On the last day, participants hiked to exposures of the Devonian reef carbonates of the Cairn Formation near the picturesque Grassi Lakes above Canmore (Figure 7).

Figure 7. Devonian outcrops above Grassi Lakes, near Canmore.

The rocks of the Cairn Formation are equivalent to the Leduc strata in the Alberta subsurface - the same rocks into which acid gas is injected at two sites in the Provost area, and in which Imperial Oil struck it rich at Leduc in 1947, kicking off the Alberta oil rush. Field trip participants were given an overview of the paleogeography during the Devonian and introduced to the characteristics of the rocks that make them such prolific hydrocarbon reservoirs and suitable targets for the injection and storage of acid gases. ❖

Publications Re-Released in Digital Form (continued)

ESR 1976-05 Hydrogeology of the Mount Robson-Wapiti Area, Alberta.

ESR 1976-04 Hydrogeology of the Grande Prairie Area, Alberta.

ESR 1976-03 Hydrogeology of the Whitecourt Area, Alberta.

ESR 1976-02 Hydrogeology of the Iosegun Lake Area, Alberta.

ESR 1975-02 Hydrogeology of the Medicine Hat Area, Alberta.

ESR 1975-01 Hydrogeology of the Wainwright Area, Alberta.

ESR 1974-10 Hydrogeology of the Edmonton Area (Northwest Segment), Alberta.

ESR 1974-09 Hydrogeology of the Gleichen Area, Alberta.

ESR 1974-04 Hydrogeology of the Foremost Area, Alberta.

ESR 1974-02 Hydrogeology of the Waterways-Winefred Lake Area, Alberta.

ESR 1974-01 Hydrogeology of the Lethbridge-Fernie Area, Alberta.

ESR 1972-12 A Legend and Guide for the Preparation and Use of the Alberta Hydrogeological Information and Reconnaissance Map Series.

ESR 1972-11 Hydrogeology of the Tawatinaw Area, Alberta.

ESR 1972-08 Hydrogeology of the Wabamun Lake Area, Alberta.

ESR 1972-03 Hydrogeology of the Mount Watt Area, Alberta.

ESR 1972-02 Hydrogeology of the Bison Lake Area, Alberta.

ESR 1972-01 Hydrogeology of the Drumheller Area, Alberta.

ESR 1971-03 Hydrogeology of the Rocky Mountain House Area, Alberta.

ESR 1971-02 Hydrogeology of the Grimshaw-Chinook Valley Area, Alberta.

ESR 1971-01 Hydrogeology of the Red Deer Area, Alberta.

Conferences Involving Alberta Geological Survey

Roundup 07
January 29 - February 1, 2007
The Westin Bayshore
Vancouver, British Columbia
Booth # F23

Prospectors and Developers Association of Canada
March 4-7, 2007
Metro Toronto Convention Centre
Toronto, Ontario

Calgary Mining Forum
March 20-23, 2007
Ramada Hotel
Calgary, Alberta

Recently Released Publications

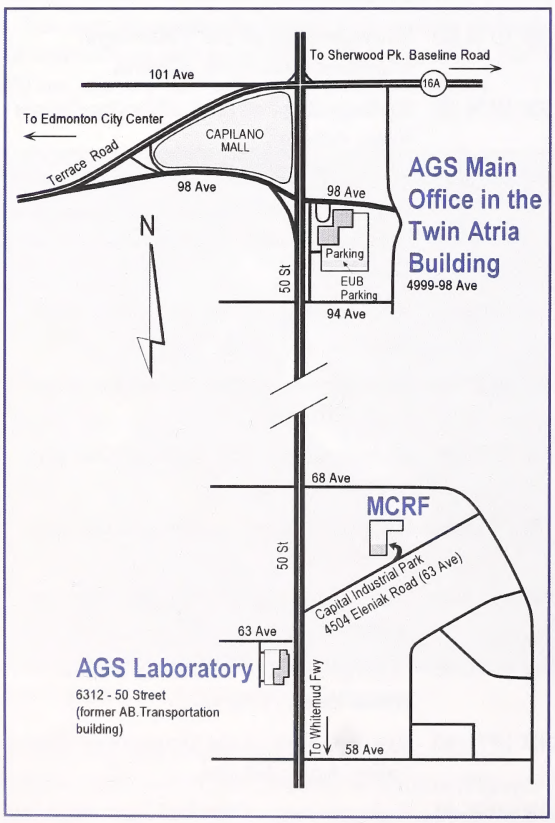
LIBRARY AND ARCHIVES CANADA
Bibliothèque et Archives Canada
3 3286 53703151 6

Earth Sciences Reports

ESR 2006-07 Turtle Mountain Field Laboratory Montioring and Research Summary Report, 2005. 44.3 MB PDF. $20.00

Maps

MAP 314 Surficial Geology of the Sawn Lake Area (NTS 84B/13). Scale 1:50 000. 9.81 MB PDF. $20.00



AGS Locations

The main office of the Alberta Geological Survey is located at

4th Floor, Twin Atria Building
4999 - 98th Avenue
Edmonton, Alberta
Canada T6B 2X3
Tel: (780) 422-1927
(780) 422-3767 Information Sales
Fax: (780) 422-1459
(780) 422-1918 Information Sales

The Alberta Geological Survey Library is located at the address above and may be contacted at
Tel: (780) 427-4663
E-mail: EUB.AGS-Library@eub.ca

Our Mineral Core Research Facility (MCRF) is located at

4504 Eleniak Road
Edmonton, Alberta

For information on the MCRF or to book a visit, contact Rob Natyshen by phone at (780) 427-4195 or by e-mail at Rob Natyshen@eub.ca